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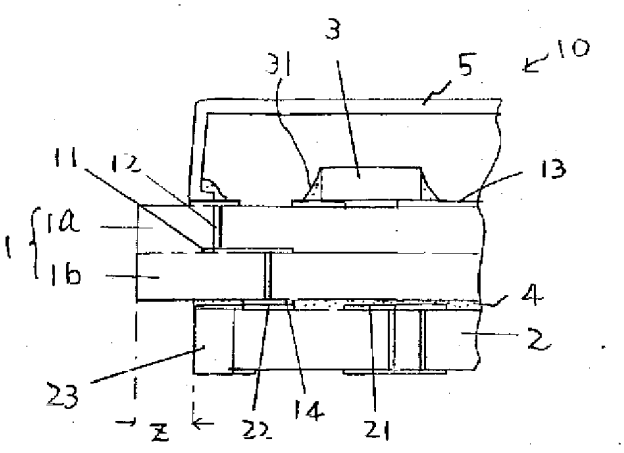
(54)【発明の名称】　複合多層配線基板

(57)【要約】
【課題】周囲の温度変化による熱膨張、収縮による接続部（電子部品素子の接続部及び多層基板の接続部）に係るストレスを減少させ、耐熱衝撃性を向上させることができる複合多層配線基板を提供することにある。とにある。
【解決手段】本発明は、一方主面に電子部品素子３を搭載し、且つ他方主面に接続用電極パッド１４を形成して成るセラミック回路基板１と、端面に外部端子電極２３を形成し、且つ一方主面に接続用電極パッド２２を形成して成るガラスエポキシ回路基板２とを備え、前記セラミック回路基板１の接続用電極パッド１４と前記ガラスエポキシ回路基板２の接続用電極パッド２２とを電気的に接続するように前記セラミック回路基板１の他方主面と前記ガラスエポキシ回路基板２の一方主面とを絶縁性接着材４を介して接合した。



【特許請求の範囲】
【請求項１】一方主面に電子部品素子を搭載し、他方主面に接続用電極パッドを形成して成るセラミック回路基板と、端面に外部端子電極を形成し、一方主面に接続用電極パッドを形成して成るガラスエポキシ回路基板とを備え、
前記セラミック回路基板の接続用電極パッドと前記ガラスエポキシ回路基板の接続用電極パッドとを当接させて前記セラミック回路基板の他方主面と前記ガラスエポキシ回路基板の一方主面とを絶縁性接着材を介して接合したことを特徴とする複合多層配線基板。
【請求項２】前記ガラスエポキシ回路基板の外形寸法は、前記セラミック回路基板に接合した時に、該セラミック回路基板の他方主面の外周部に余白領域が形成されるように、前記セラミック回路基板の外形寸法に比較して小さくなっていることを特徴とする請求項１記載の複合多層配線基板。
【請求項３】前記セラミック回路基板の他方主面に被着形成された接続用電極パッド及び前記ガラスエポキシ回路基板の一方主面に被着形成された接続用電極パッドの少なくとも一方は、基板主面に所定厚みを有する導体膜で構成されていることを特徴とする請求項１記載の複合多層配線基板。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、通信機器、特に移動体通信装置に用いられる電圧制御発振器、アンテナフィルターなどの高周波モジュール部品を構成する複合多層配線基板に関するものである。
【０００２】
【従来の技術】従来の高周波モジュール部品として電圧制御発振器を一例に、図面を用いて説明する。図５に示す電圧制御発振器は、多層配線基板７０とシールドケース７２とから構成されている。この多層配線基板７０の表面に、所定回路を配線パターン７３、該配線パターン７３に接続する抵抗、コンデンサ、トランジスタなどの各種電子部品素子（図では現れない）が搭載されている。多層配線基板７０は、セラミック層またはガラスエポキシ層からなる絶縁層７１ａ～７１ｃと、該絶縁層７１ａ～７１ｃの層間に配置された所定配線パターン（図には現れない）、該絶縁層７１ａ～７１ｃの層厚み方向に貫くビアホール導体７４とから構成されている。
【０００３】また、多層配線基板７０の側面には、半円形状の端面スルーホール導体が形成されており、この半円形状の端面スールホール導体は、外部端子電極７５として用いられる。
【０００４】端面スルーホール電極である外部端子電極７５と所定配線パターンとは、所定内部に形成された配線パターンや表面に形成された配線パターンなどに接続されている。
【０００５】多層配線基板７０の表面、即ち、部品搭載面には各種電子部品素子を被覆するようにシールドケース７２が設けられている。
【０００６】なお、シールドケース７２の一部（延出部）７７は、外部端子電極７５のなかで、グランド電位となる外部端子電極７５内に配置・接続されている。また、シールドケース７２の開口周囲は、多層回路基板７０の表面に当接されている。また、表面に形成された配線パターン７３とシールドケース７２の開口周囲とが交差する部位には、配線パターン７３と短絡しないように切り欠け部７６が形成されている。
【０００７】このような多層回路基板は次のように製造される。尚、回路基板は、絶縁層としてセラミック層を用いた例で示す。
【０００８】まず、各セラミック層７１ａ～７１ｃとなるグリーンシートを用意する。尚、グリーンシートは、最終的な切断や分割によって複数の基板領域が取得できる程度の形状である。
【０００９】次に、各セラミックグリーンシートに、ビアホール導体や半円形状のスルーホール導体となる貫通穴をパンチングなどで形成する。その後、各セラミックグリーンシート上に、所定配線パターンとなる導体膜、ビアホール導体となる導体部材、スルーホールの内壁面に被着される導体の導体部材を、導電性ペーストの印刷手法により形成する。
【００１０】その後、各セラミックグリーンシートを、多層基板７０の積層順に応じて、積層して大型未焼成状態の積層基板を形成する。その後、各多層回路基板７０の領域に応じて分割溝を形成し、焼成処理する。
【００１１】その後、分割処理を行ない、基板の表面に、所定電子部品を搭載し、シールドケース７２を被覆接合する。尚、分割処理は、基板の表面に所定電子部品を搭載し、シールドケース７２を被覆した後に行っても構わない。ガラスエポキシから成る積層基板の場合は、基板をエッチングして回路パターンを形成する。この基板の上面または下面にプリプレグを塗布し硬化させる、この面にエッチングまたは無電界銅メッキで銅を析出させて回路パターンを形成する、同時に下層とのスルーホールまたはビアホールを作り込んでおく、これは後に内部スルーホールとなる。プリプレグの塗布を必要な積層数にまで繰り返して複数個分の入った親基板を形成する。次に、上記親基板の分割部にスルーホールメッキを施し外部端子電極を形成する。
【００１２】
【発明が解決しようとする課題】しかしながら、従来例の多層回路基板では、次のような問題点があった。
【００１３】多層基板に搭載される電子部品素子の多くは、積層セラミックコンデンサ、セラミック基板をベースとしてチップ抵抗器などのようにセラミック製であり、基板材料にガラスエポキシ基板を用いた場合、これ

らセラミック材料とガラスエポキシ基板に代表される樹脂材料との間には大きな熱膨張差が存在する。例えば、セラミック材料の熱膨張係数は、概略６～８×１０$^{-6}$ｍｍ／℃であり、ガラスエポキシ基板の熱膨張係数は１１～１３×１０$^{-6}$ｍｍ／℃である。

【００１４】この多層基板の用途が、自動車などの車載部品では大きな温度変化と、激しい振動が加わる過酷な条件となり、ガラスエポキシ多層基板と、該基板に搭載される各電子部品素子との間で、熱膨張係数の差を生じて、各電子部品素子の半田接続部が過酷な熱衝撃試験に耐えられず断線する。

【００１５】また、多層配線基板をセラミック基板で構成した場合、一般に実装基板はガラスエポキシ基板が多用されており、この実装基板と多層配線基板との間の熱膨張や収縮により多層配線基板の外部端子電極などでの半田接続部で断線が発生する。

【００１６】本発明は上記の問題に鑑みて案出されたものであり、周囲の温度変化による熱膨張、収縮による接続部（電子部品素子の接続部及び多層基板の接続部）に係るストレスを減少させ、耐熱衝撃性を向上させることができる複合多層配線基板を提供することにある。

【００１７】また、別の目的は、生産性が効率化できる構造を有する複合多層配線基板を提供することにある。

【００１８】

【課題を解決するための手段】本発明は、一方主面に電子部品素子を搭載し、他方主面に接続用電極パッドを形成して成るセラミック回路基板と、端面に外部端子電極を形成し、一方主面に接続用電極パッドを形成して成るガラスエポキシ回路基板とを備え、前記セラミック回路基板の接続用電極パッドと前記ガラスエポキシ回路基板の接続用電極パッドとを当接して前記セラミック回路基板の他方主面と前記ガラスエポキシ回路基板の一方主面とを絶縁性接着材を介して接合したことを特徴とする複合多層配線基板である。

【００１９】第２の発明は、前記ガラスエポキシ回路基板の外形寸法は、前記セラミック回路基板に接合した時に、該セラミック回路基板の他方主面の外周部に余白領域が形成されるように、前記セラミック回路基板の外形寸法に比較して小さくなっていることである。

【００２０】第３の発明は、前記セラミック回路基板の他方主面に被着形成された接続用電極パッド及び前記ガラスエポキシ回路基板の一方主面に被着形成された接続用電極パッドの少なくとも一方は、基板に所定厚みを有する導体膜で構成されていることである。

【作用】本発明では、電子部品素子が搭載される上部側の回路基板が、セラミック回路基板で構成され、外部端子電極を有する下部側の回路基板がガラスエポキシ基板で構成されている。

【００２１】このため、実装基板（ガラスエポキシ基板）に接合する部位は、下部側のガラスエポキシ基板であるため、過酷な温度条件でも両者の接続部において、亀裂や剥離が発生せず、安定した接合が維持できる。

【００２２】また、電子部品素子は上部側のセラミック回路基板に搭載されるため、過酷な温度条件でも電子部品素子の接続部に亀裂や剥離が発生せず、安定した接合が維持できる。

【００２３】また、両回路基板の電気的な接続は、セラミック回路基板の他方主面に形成された接続用電極パッドと、ガラスエポキシ回路基板の一方主面に形成された接続用電極パッドとの当接接続であるため、過酷な温度変化の条件下でも、安定した接続が維持できる。

【００２４】また、両回路基板の接合は、接続用電極パッドを除く部位（基板間の広範囲の面積）に介在させた絶縁接着材を用いている。これにより、両基板間を略全面接着させることにより、過酷な熱衝撃を受けてもその応力を基板全面に分散させることができ、機械的な接合の信頼性を高めることができる。

【００２５】また、第２の発明のように、セラミック回路基板の外形寸法が、ガラスエポキシ回路基板の外形寸法に比較して、ひと回り大きくなっている。即ち、セラミック回路基板を製造工程で、複数の回路基板領域が抽出できる大型セラミック基板を用い、各回路基板領域の他方主面に絶縁性接着材を介在させてガラスエポキシ基板を加圧・貼着させた時、余分の絶縁性接着材がセラミック回路基板の他方主面外周の余白領域にはみ出させることができる。これにより、両回路基板の接続用電極パッドどうしの当接間には絶縁性接着材を存在させることがなく、両者の安定した接続が行えることになる。また、この余白領域に大型セラミック基板の分割溝または切断線が位置するため、ガラスエポキシ基板を大型セラミック回路基板の各回路素子領域の他方主面に夫々貼着しても、大型セラミック基板の分割または切断処理工程までは１つの大型基板として取り扱えるため、その生産効率が良好となる。

【００２６】また、互いに当接される接続用電極パッドの一方または両方が、基板主面から突出した導体膜であるため、両導体膜の当接が安定する。したも、両電極パッドを当接した結果、突出する導体膜の厚みに対応して両回路基板間に間隙が発生する。そして、この間隙には、絶縁性接着材が介在されるため、充分な厚みの接着層となり、熱膨張係数の差による応力を吸収されやすくなる。

【００２７】

【発明の実施の形態】以下、本発明の複合多層回路基板を図面に基づいて詳細する。

【００２８】図１は、本発明の複合多層配線基板の外観斜視図であり、図２はその一部の構造断面図であり、図３はその一部を分解した状態の構造断面図である。この複合多層配線基板１０は、例えば２層構造のセラミック回路基板１と、１層構造のガラスエポキシ基板２とから

構成されている。セラミック回路基板１は、セラミック層１ａ、１ｂとから構成されており、その層間には、内部配線パターン１１が配置されいる。また、各セラミック層１ａ、１ｂの厚み方向にはビアホール導体１２が形成されている。また、セラミック回路基板１の一方主面（表面）には、表面の配線パターン１３が被着形成されている。この表面の配線パターン１３上には、積層セラミックコンデンサ、セラミック基板をベースとしたチップ抵抗器、トランジスタなどの各電子部品素子３が例えば半田３１などを介して接続されている。さらに、セラミック回路基板１の他方主面（裏面:ガラスエポキシ回路基板２に接合する接合面）には、下部側に配置されるガラスエポキシ回路基板２と電気的に接続するための接続用電極パッド１４が被着形成されている。

【００２９】また、ガラスエポキシ回路基板２は、例えば１層のガラスエポキシ層から構成されており、そのガラスエポキシ回路基板２の一方主面（セラミック回路基板１に接合する接合面）には、配線パターン２１が形成されている。この配線パターン２１は、その一部が接続用電極パッド２２として用いられる。このガラスエポキシ回路基板２の平面状の外形寸法は、上述のセラミック回路基板１の平面状の外形寸法に比較して、Ｘ方向、Ｙ方向ともに、若干短くなっており、一回り小さい形状となっている。その結果、セラミック回路基板１の他方主面の外周には、余白領域Ｚが形成される。

【００３０】また、ガラスエポキシ回路基板２の端面には、基板の厚み方向に貫く半円形状の凹部が形成され、且つその内部に導体膜が被着された複数のスルーホール導体２３が形成されている。このスルーホール導体２３は、図４に示す外部の実装基板４０と接続される外部端子電極として用いられる。

【００３１】この外部端子電極２３は、ガラスエポキシ基板２の一方主面に形成された配線パターン２１に接続されている。

【００３２】尚、このガラスエポキシ基板２を複数のガラスエポキシ層からなる積層基板として用いても構わない。この場合、層間には所定回路網を構成する配線パターン、所定機能を発生される配線パターンを配置し、さらに、外部端子電極２３には、この層間の配線パターンで電気的に接続することもできる。また、各絶縁層の厚み方向を貫くスルーホール導体を形成してもよい。ここで、セラミック回路基板１において、各絶縁層１a～1ｃを貫くビアホール導体は、貫通孔内に導体部材が詰まって形成されるが、ガラスエポキシ回路基板２においては、基板の厚み方向を貫く導体は，貫通孔の内壁に導体膜を被着したスルーホール導体で形成される。

【００３３】また、セラミック回路基板１とガラスエポキシ回路基板２とは、セラミック回路基板１の他方主面に形成した接続用電極パッド１４とガラスエポキシ回路基板２の一方主面に形成された接続用電極パッド２２とを当接させて、例えばガラスエポキシ回路基板２の一方主面の接続用電極パッド２２を回避して塗布された、例えば無機物フィラー含有しないエポキシ樹脂などの絶縁性接着材４を介して両回路基板１、２が接合される。

【００３４】また、セラミック回路基板１の表面には、各電子部品素子３や配線パターン１３を覆うシールドケース５が配置され、これにより、図１に示す複合多層配線基板１０が構成される。

【００３５】尚、シールドケース５は、セラミック回路基板１の表面に形成されたグランド電位の配線パターン１３に半田などを介して接続されるとともに固定される。

【００３６】この複合多層配線基板１０は以下のようにして形成される。

【００３７】まず、セラミック回路基板１が複数抽出できる大型セラミック回路基板を形成する。

【００３８】これは、例えば、セラミック層１aとなる大型セラミックグリーンシート及びセラミック層1ｂとなる大型セラミックグリーンシートを準備し、それぞれのグリーンシートの各回路基板領域に、ビアホール導体１２となる貫通孔を形成する。次に、グリーンシートの各回路基板領域の貫通孔に導電性ペーストの印刷により供給し、その表面に各配線パターン１１及び１２となる導体膜を導電性ペーストの印刷により形成する。次に、各グリーンシートを積層して、大型未焼成基板を形成し、各セラミック回路基板1の領域に応じて、分割溝を形成する。その後、例えば、大型未焼成回路基板の他方主面において、接続用電極パッド14となる導体膜を導電性ペーストの印刷により形成する。そして、焼成処理することにより、複数のセラミック回路基板1が抽出できる大型セラミック回路基板が完成する。また、ガラスエポキシ基板２は別工程で形成される。銅箔が張られた大型ガラスエポキシ板において、所定回路網に応じて配線パターン２１及び接続用電極パッド２２に応じてエッチング処理して、余分な銅箔が除去する。また、また、各ガラスエポキシ回路基板２となる境界部分には、ガラスエポキシ回路基板２の側面の半円形状凹部及び導体膜からなる外部端子電極２３が形成されるように、あらかじめ円形貫通孔及びその内面に銅箔を形成しておき、必要に応じてニッケルメッキと金メッキを施しておく。その後、各ガラスエポキシ回路基板２の領域毎に切断処理する。

【００３９】ここで、セラミック回路基板１となる大型セラミック回路基板の他方主面の接続用電極パッド１４は、グリーンシートの積層圧着後に形成するため、その厚みは、基板の表面から約５～１０μｍある。

【００４０】そして、大型セラミック回路基板の他方主面の各回路基板領域の接続用電極パッド１４に、ガラスエポキシ回路基板２の一方主面に形成された接続用電極パッド２２を当接させ、両回路基板１、２間で電気的な

接続を得るとともに両回路１、２間に、ガラスなどの無機物フィラーを含まないエポキシ系樹脂などの絶縁性接着材を介在させ、加圧状態で加熱する。

【００４１】これにより、回路基板１、２間に介在した接着材は、低粘度化し、両接続用電極パッド１４、２２との間の接続が達成されるとともに、両回路基板１、２を、接続用電極パッド１４、２２の当接部分をのぞく略全面接着を達成する。このようにして、セラミック基板とガラスエポキシ基板は絶縁性を有する耐熱性樹脂で接着接合させることができる。

【００４２】すなわち、大型セラミック回路基板の他方主面の各回路基板領域には、切断されたガラスエポキシ回路基板２がそれぞれ貼着されることになる。

【００４３】次に、セラミック回路基板１の各回路基板領域の一方主面に、各種電子部品素子３をマウントし、リフロー半田つけ方法で半田付けする。また、必要に応じて、機能的な動作を行う配線パターン１３を特性調整のために、トリミングを行ったり、各種可変電子部品などの調整処理を行う。さらに、各電子部品素子３や配線パターン１３を覆よううにシールドケース５が被覆・固定する。

【００４４】その後、大型セラミック回路基板を各セラミック回路基板１に分割溝にそって分割処理を行う。

【００４５】これにより、各セラミック回路基板１の他方主面に、ガラスエポキシ回路基板２が貼着された複合多層配線基板１０を得ることが出来る。

【００４６】こうして得られた複合多層配線基板１０は、図4に示すように、実装基板４０に形成された所定配線パッド４１に半田４２によって半田接合される。具体的には、実装基板４０の配線パターン４１の適切な個所に半田クリームが印刷し、次に、複合多層配線基板の外部電極２３がクリーン半田を印刷した上に位置されるように配置する。その後、実装基板４０上にその他の電子部品を搭載してリフロー半田付けの工程を経ることによって実装される。

【００４７】上述の構造では、本発明では、電子部品素子３が搭載される上部側の回路基板が、セラミック回路基板１で構成され、このセラミック回路基板１と電気的に接続する下部側の回路基板がガラスエポキシ回路基板２で構成されている。そして、外部回路とは、このガラスエポキシ回路基板２の端面に形成された外部端子電極２３によって接合される。

【００４８】このため、実装基板４０として多様されるガラスエポキシ基板上に実装し、過酷な温度条件下でも外部端子電極２３部分に、熱膨張係数の差に起因する外部端子電極２３やその半田接合部分４１に亀裂や剥離が発生せず、安定した接合が維持できる。

【００４９】また、電子部品素子３はセラミック回路基板１に搭載されるため、過酷な温度条件でも電子部品素子３の接続部である、例えば半田３１接合部分に亀裂や剥離が発生せず、安定した接合が維持できる。

【００５０】また、両回路基板１、２の電気的な接続は、セラミック回路基板１の他方主面に形成された接続用電極パッド１４と、ガラスエポキシ回路基板２の一方主面に形成された接続用電極パッド２２との当接接続であるため、過酷な温度変化の条件下でも、安定した電気的接続が維持できる。

【００５１】また、両回路基板１、２の接合は、接続用電極パッド１４、２２を除く部位（基板間の広範囲の面積）に介在させた絶縁接着材４を用いている。これにより、両基板１、２間を略全面接着させることにより、過酷な熱衝撃を受けてもその応力を全面に分散させることができ、機械的な接合の信頼性を高めることができる。

【００５２】また、セラミック回路基板１の外形寸法が、ガラスエポキシ回路基板２の外形寸法に比較して、ひと回り大きくなっている。即ち、セラミック回路基板１を製造工程で、複数の回路基板領域が抽出できる大型セラミック基板を用い、各回路基板領域の他方主面に絶縁性接着材４を介在させてガラスエポキシ基板２を貼着（加熱圧着）した時、余分の絶縁性接着材４がセラミック回路基板１の他方主面の外周の余白領域Ｚにはみ出させることができる。

【００５３】これにより、両回路基板１、２の接続用電極パッド１４、２２間の接続を確実に行えることになる。また、この余白部分に大型セラミック基板の分割または切断線が位置するため、ガラスエポキシ基板２を大型セラミック回路基板の各回路素子領域の他方主面に夫々貼着しても、大型セラミック基板の分割または切断処理工程までは１つの大型基板として取り扱えるため、その生産効率が良いことになる。

【００５４】また、電子部品素子３を搭載するセラミック回路基板１とやや大きいため、部品搭載領域を十分に確保することができる。同時に、ガラスエポキシ回路基板２がやや小さいため、実装基板４０の実装占有面積を小さくすることができる。

【００５５】また、互いに当接される接続用電極パッドの一方、例えばセラミック回路基板１側の接続用電極パッド１４が、回路基板１の他方主面から５～１０μｍだけ突出した導体膜であるため、両電極パッド１４、２２とを安定的に当接することができる。

【００５６】しかも、両電極パッド１４、２２を当接した結果、突出した厚みに対応して両回路基板１、２間に間隙が発生する。そして、この間隙には、絶縁性接着材４が介在される。即ち、充分な厚みの接着層となり、熱膨張係数の差による応力を吸収され易くなる。

【００５７】そして、実装基板４０に半田接合した場合、外部端子電極２３部分に形成される半田フィレットは、セラミック回路基板１の余白部分で平面的に隠蔽されるため、実装基板４０上において実装占有面積が小さく、且つ強固な実装が可能となり、しかも、外部からこ

の半田接合部分に衝撃が印加されにくいため、その劣化もない。

【００５８】次に、本発明の複合多層配線基板を路高周波モジュールの別な例としてアンテナ切り替えモジュールの実施の形態を説明する。アンテナモジュールは送信モジュールと受信モジュールとでアンテナを切り替えて使うためのスイッチモジュールでその回路構成は大きくスイッチとフィルターからなっている。

【００５９】アンテナモジュールの場合、上部のセラミック回路基板１にＰＩＮダイオードを始めとする電子部品素子３を搭載してスイッチ回路を形成する。下部側のガラスエポキシ回路基板２にはストリップラインによるフィルターのパターンを形成する。このとき下部側のガラスエポキシ回路基板２の段階でフィルターの周波数調整を済ませておくことが出来る。このようにすれば、下部側のガラスエポキシ回路基板２の形成時にトリミング処理などの必要な処理を行え、しかも、上部側のセラミック回路基板１の形成とは独立に処理加工することができる。

【００６０】これにより、セラミック回路基板１とガラスエポキシ回路基板２との貼り合わせ後に、特性の調整やトリミングが省略乃至ごく僅かのトリミングで済ませることができる。

【００６１】また、下部側のガラスエポキシ回路基板２にはストリップラインによるフィルターのパターンを形成し、上部側のセラミック回路基板１にＰＩＮダイオードを始めとする電子部品素子３を搭載してスイッチ回路を形成するといった構成をとった場合、ストリップラインによるフィルターはセラミック基板の回路によって外部からシールドされた格好となりモジュールによってはシールドケース５が不要となる。これによって基板面積をさらに小型化できる。

【００６２】さらに、上部側のセラミック回路基板1は共通で使えるため、大型セラミック基板に対して貼着するガラスエポキシ回路基板２（フィルターパターンを変えて、特性や周波数の異なるもの）を選択して組み合わせることにより、部材の共通化を図り量産効果を高めることができる。

【００６３】尚、上述の実施例では、セラミック回路基板１側の接続用電極パッド１４を実質的に厚みを持たせているが、ガラスエポキシ回路基板２側の一方主面の接続用電極パッド２２も、基板主面から突出させるようにしても構わない。

【００６４】

【発明の効果】以上のように本発明の複合多層配線基板によれば、セラミック回路基板とガラスエポキシ回路基板を貼り合わせて構成である。そして、電子部品素子が搭載される側のセラミック回路基板と、実装基板に実装される側のガラスエポキシ回路基板で構成している。これによって、セラミック回路基板と電子部品素子との間、ガラスエポキシ回路基板と実装基板との間で、熱膨張係数の差による接合部、即ち、半田付け部の劣化を有効に抑えることができる。

【００６５】またセラミック回路基板は、ガラスエポキシ回路基板に比較して大型基板となっている。しかも、外部端子電極などを具備していない。このため、電子部品素子の部品搭載面を広く使うことができ、実装占有面積が小さく、且つ部品搭載点数を多くすることができ、小型で、高密度実装が可能な複合多層配線基板となる。

【００６６】また、互いに接続される接続用電極パッドの少なくとも一方が基板より所定厚みで突出しているため、両者の電気的な接続が確実となり，安定した電気的な接続が維持でき、物理的に形成される間隙に絶縁接着材を介在させることができるため、これにより安定した機械的な接合が達成される。

【図面の簡単な説明】

【図１】本発明の複合多層配線基板を示す斜視図である。

【図２】本発明の複合多層配線基板の部分断面図である。

【図３】図２に対応する部位の分解断面図である。

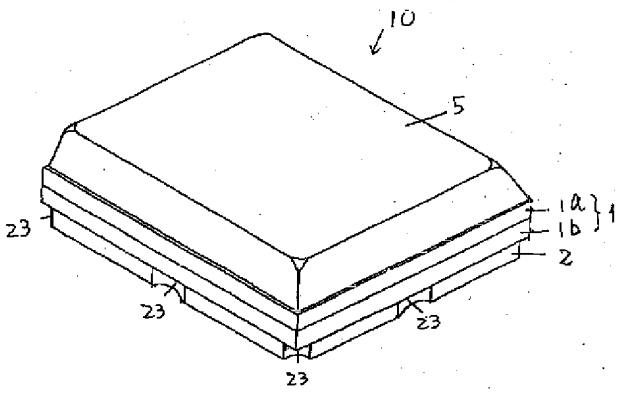
【図４】本発明の実装基板に実装した時の部分側面図である。

【図５】従来の多層配線基板の斜視図である。

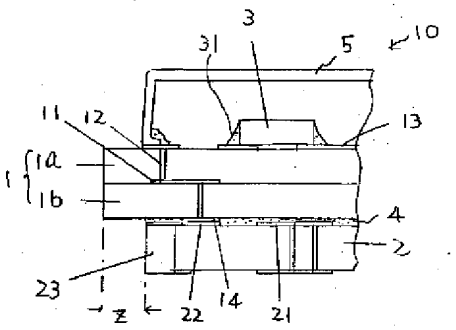
【符号の説明】

１　セラミック回路基板
２　ガラスエポキシ回路基板
３　電子部品
４　絶縁性接着材
５　シールドケース
１１　内部の配線パターン
１２　ビアホール導体
１３　表面の配線パターン
１４　セラミック回路基板側の接続用電極パッド
２１　ガラスエポキシ回路基板側の配線パターン
２２　ガラスエポキシ回路基板側の接続用電極パッド
４０　実装基板

【図1】


10
5
1a
1b
1
2
23
23
23
23

【図2】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11
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13
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1a
1b
4
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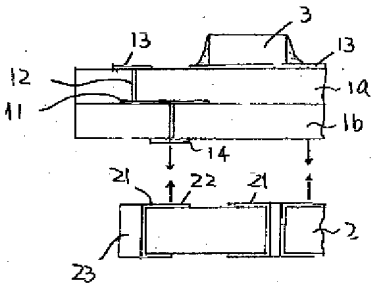
Z
22
14
21

【図3】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1a
1b
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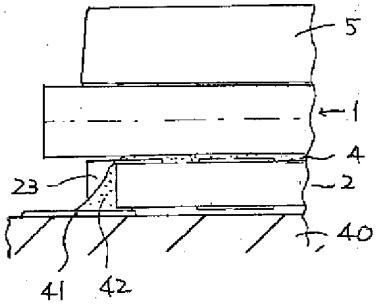
2
23

【図4】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4
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2
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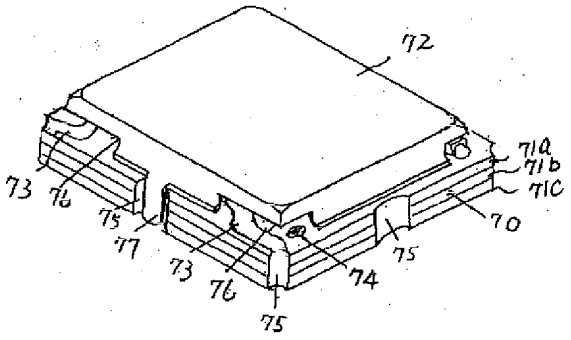
41
42

【図5】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PATENT ABSTRACTS OF JAPAN

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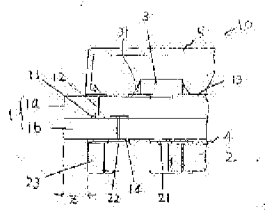
(72)Inventor : KITA HIROYUKI

(54) COMPOUND MULTILAYER INTERCONNECTION BOARD



(57)Abstract:

PROBLEM TO BE SOLVED: To a compound multilayer interconnection board for reducing stress that is applied to a connection section (the connection section of electronic component elements and that of a multilayer substrate) due to thermal expansion and shrinkage by ambient temperature change, and improving thermal shock resistance.

SOLUTION: The compound multilayer interconnection board comprises a

ceramic circuit board 1 where the electronic component elements 3 are mounted to one main surface and an electrode pad 14 for connection is formed on the other main surface, and a glass epoxy circuit board 2 where an external terminal electrode 23 is formed on the end face and an electrode pad 22 for connection is formed on one main surface. The other main surface of the ceramic circuit board 1 is joined to one main surface of the glass epoxy circuit board 2 via an insulating adhesive 4 so that the electrode pad 14 for connection of the ceramic circuit board 1 is electrically connected to the electrode pad 22 for connection of the glass epoxy circuit board 2.

LEGAL STATUS

[Date of request for examination]

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[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]

[Claim 1] The ceramic circuit board which carries an electronic-parts component in a principal plane on the other hand, forms the electrode pad for connection in an another side principal plane, and grows into it, Form an external terminal electrode in an end face, and it has the glass epoxy circuit board which forms the electrode pad for connection in a principal plane, and grows into it on the other hand. The compound multilayer-interconnection substrate which the electrode pad for connection of said ceramic circuit board and the electrode pad for connection of said glass epoxy circuit board are made to contact, and is characterized by the another side principal plane of said ceramic circuit board, and the thing of said glass epoxy circuit board for which the principal plane was joined through the insulating binder on the other hand.

[Claim 2] The dimension of said glass epoxy circuit board is a compound multilayer-interconnection substrate according to claim 1 characterized by being small as compared with the dimension of said ceramic circuit board so that a margin field may be formed in the periphery section of the another side principal plane of this ceramic circuit board when it joins to said ceramic circuit board.

[Claim 3] the conductor with which either [at least] the electrode pad for connection by which covering formation was carried out at the another side principal plane of said ceramic circuit board, or the electrode pad for connection of said glass epoxy circuit board by which covering formation was carried out on

the other hand at the principal plane has predetermined thickness in a substrate principal plane -- the compound multilayer-interconnection substrate according to claim 1 characterized by consisting of film.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the compound multilayer-interconnection substrate which constitutes high frequency modular components, such as communication equipment especially a voltage controlled oscillator used for a mobile communication device, and an antenna filter.
[0002]
[Description of the Prior Art] As a conventional high frequency modular component, a drawing is used for an example and a voltage controlled oscillator is explained to it. The voltage controlled oscillator shown in drawing 5 consists of a multilayer-interconnection substrate 70 and a shielding case 72. Various electronic-parts components (it does not appear by a diagram), such as the resistance and the capacitor which connect a predetermined circuit to a circuit

pattern 73 and this circuit pattern 73, and a transistor, are carried in the front face of this multilayer-interconnection substrate 70. the beer hall through which it pierces in the direction of a bed depth of a predetermined circuit pattern (it does not appear in drawing), and these insulating layers 71a-71c arranged between the insulating layers 71a-71c which the multilayer-interconnection substrate 70 becomes from a ceramic layer or a glass epoxy layer, and the layer of these insulating layers 71a-71c -- it consists of conductors 74.

[0003] moreover -- the side face of the multilayer-interconnection substrate 70 -- a hemicycle-like end-face through hole -- a conductor forms -- having -- **** -- the end-face SURU hole of the shape of this hemicycle -- a conductor is used as an external terminal electrode 75.

[0004] The external terminal electrode 75 which is an end-face through hole electrode, and the predetermined circuit pattern are connected to the circuit pattern formed in the interior of predetermined, the circuit pattern formed in the front face.

[0005] The shielding case 72 is formed so that various electronic-parts components may be covered, the front face, i.e., the element-placement side, of the multilayer-interconnection substrate 70.

[0006] In addition, some shielding cases (extension section) 72 77 are arranged and connected into the external terminal electrode 75 used as ground potential in the external terminal electrode 75. Moreover, the perimeter of opening of a shielding case 72 is contacted by the front face of a multilayered circuit board 70. Moreover, it cuts in the part to which the circuit pattern 73 and the opening perimeter of a shielding case 72 which were formed in the front face cross so that it may not connect with a circuit pattern 73 too hastily, and the chip section 76 is formed in it.

[0007] Such a multilayered circuit board is manufactured as follows. In addition, the example which used the ceramic layer as an insulating layer shows the circuit board.

[0008] First, the green sheet used as each ceramic layers 71a-71c is prepared.

In addition, a green sheet is a configuration which is extent which can acquire two or more substrate fields by final cutting and division.

[0009] next, each ceramic green sheet -- a beer hall -- the through hole of the shape of a conductor or a hemicycle -- the through hole used as a conductor is formed by punching etc. then, the conductor which serves as a predetermined circuit pattern on each ceramic green sheet -- the film and a beer hall -- a conductor and the becoming conductor -- the conductor of the conductor put on the internal surface of a member and a through hole -- a member is formed by the printing technique of a conductive paste.

[0010] Then, each ceramic green sheet is ****(ed) according to the order of a laminating of the multilayer substrate 70, and the laminated circuit board in large-sized the condition of not calcinating is formed. Then, according to the field of each multilayered circuit board 70, a division slot is formed and baking processing is carried out.

[0011] Then, division processing is performed, on the surface of a substrate, predetermined electronic parts are carried and covering junction of the shielding case 72 is carried out. In addition, division processing carries predetermined electronic parts on the surface of a substrate, and after covering a shielding case 72, it may be performed. In the case of the laminated circuit board which consists of glass epoxy, a substrate is etched, and it forms a circuit pattern. This which makes the top face or inferior surface of tongue of this substrate apply and harden prepreg, which copper is deposited in this field by etching or non-electric-field coppering, and forms a circuit pattern in it and which makes a through hole or a beer hall with a lower layer to coincidence serves as an internal through hole behind. The parent substrate into which spreading of prepreg was repeated even to the required number of laminatings, and two or more parts went is formed. Next, an almsgiving external terminal electrode is formed in the division section of the above-mentioned parent substrate for through hole plating.

[0012]

[Problem(s) to be Solved by the Invention] However, there were the following

troubles in the multilayered circuit board of the conventional example.

[0013] Many of electronic-parts components carried in a multilayer substrate use a stacked type ceramic condenser and a ceramic substrate as the base, it is a product made from a ceramic like a chip resistor, and when a glass epoxy group plate is used for a substrate ingredient, a big differential thermal expansion exists between these ceramic ingredient and the resin ingredient represented by the glass epoxy group plate. For example, the coefficient of thermal expansion of a ceramic ingredient is a six to 8x10 to 6 mm/degree C outline, and the coefficient of thermal expansion of a glass epoxy group plate is 11 to 13x10 to 6 mm/degree C.

[0014] It becomes a temperature change with mounted components, such as an automobile, with the big application of this multilayer substrate, and the severe condition which an intense vibration joins, and between a glass epoxy multilayer substrate and each electronic-parts component carried in this substrate, in a severe spalling test, the difference of a coefficient of thermal expansion is produced and it is disconnected [the solder connection of each electronic-parts component cannot bear, and].

[0015] Moreover, when a multilayer-interconnection substrate is constituted from a ceramic substrate, generally, the glass epoxy group plate is used abundantly and an open circuit generates a mounting substrate in the solder connection in the external terminal electrode of a multilayer-interconnection substrate etc. by the thermal expansion and contraction between this mounting substrate and a multilayer-interconnection substrate.

[0016] This invention is thought out in view of the above-mentioned problem, the stress concerning the thermal expansion by the surrounding temperature change and the connection (the connection of an electronic-parts component and connection of a multilayer substrate) by contraction is decreased, and it is in offering the compound multilayer-interconnection substrate which can raise thermal shock resistance.

[0017] Moreover, another purpose is to offer the compound multilayer-

interconnection substrate which has the structure which can increase the efficiency of productivity.

[0018]

[Means for Solving the Problem] The ceramic circuit board which this invention carries an electronic-parts component in a principal plane on the other hand, and forms the electrode pad for connection in an another side principal plane, and grows into it, Form an external terminal electrode in an end face, and it has the glass epoxy circuit board which forms the electrode pad for connection in a principal plane, and grows into it on the other hand. It is the compound multilayer-interconnection substrate which contacts the electrode pad for connection of said ceramic circuit board, and the electrode pad for connection of said glass epoxy circuit board, and is characterized by the another side principal plane of said ceramic circuit board, and the thing of said glass epoxy circuit board for which the principal plane was joined through the insulating binder on the other hand.

[0019] When the 2nd invention joins the dimension of said glass epoxy circuit board to said ceramic circuit board, as a margin field is formed in the periphery section of the another side principal plane of this ceramic circuit board, it is small as compared with the dimension of said ceramic circuit board.

[0020] the conductor with which either [at least] the electrode pad for connection with which covering formation of the 3rd invention was carried out at the another side principal plane of said ceramic circuit board, or the electrode pad for connection of said glass epoxy circuit board by which covering formation was carried out on the other hand at the principal plane has predetermined thickness in a substrate -- it is consisting of film.

[Function] The circuit board by the side of the upper part in which an electronic-parts component is carried consists of the ceramic circuit boards, and the circuit board by the side of the lower part which has an external terminal electrode is constituted from this invention by the glass epoxy group plate.

[0021] For this reason, since the part joined to a mounting substrate (glass epoxy

group plate) is a glass epoxy group plate by the side of the lower part, it can maintain the junction by which a crack or exfoliation did not occur and were stabilized in both connection also on severe temperature conditions.

[0022] Moreover, since an electronic-parts component is carried in the ceramic circuit board by the side of the upper part, it can maintain the junction by which a crack or exfoliation did not occur and were stabilized in the connection of an electronic-parts component also on severe temperature conditions.

[0023] Moreover, since electric connection of both the circuit boards is contact connection between the electrode pad for connection formed in the another side principal plane of the ceramic circuit board, and the electrode pad for connection of the glass epoxy circuit board formed in the principal plane on the other hand, it can maintain the stable connection also under the conditions of a severe temperature change.

[0024] Moreover, junction of both the circuit boards uses the insulating binder made to be placed between the parts (wide range area between substrates) except the electrode pad for connection. Thereby, by pasting up between both substrates completely [abbreviation], even if it receives a severe thermal shock, the stress can be distributed all over a substrate, and the dependability of mechanical junction can be raised.

[0025] Moreover, the dimension of the ceramic circuit board is large the 1 surroundings like the 2nd invention as compared with the dimension of the glass epoxy circuit board. That is, when an insulating binder is made to be placed between the another side principal planes of each circuit board field and a glass epoxy group plate is made to pressurize and stick using the large-sized ceramic substrate from which two or more circuit board fields can extract the ceramic circuit board by the production process, an excessive insulating binder can make it overflow into the margin field of the another side principal plane periphery of the ceramic circuit board. Connection by which did not make an insulating binder exist between contact of the electrode pads for connection of both the circuit boards, and both were stabilized by this can be made. Moreover, since the

division slot or cutting plane line of a large-sized ceramic substrate is located in this margin field, even if it sticks a glass epoxy group plate on the another side principal plane of each circuit element field of the large-sized ceramic circuit board, respectively, since division or cutting down stream processing of a large-sized ceramic substrate can deal with it as one large-sized substrate, that productive efficiency becomes good.

[0026] moreover, the conductor which both electrode both [one side or] for connection which are contacted mutually projected from the substrate principal plane -- since it is the film -- both -- a conductor -- membranous contact is stabilized. the conductor with which the bottom also projects as a result of contacting a two-electrodes pad -- corresponding to membranous thickness, a gap occurs among both the circuit boards. And since it is placed between these gaps by the insulating binder, it becomes the glue line of sufficient thickness and the stress by the difference of a coefficient of thermal expansion becomes is easy to be absorbed.

[0027]

[Embodiment of the Invention] Hereafter, based on a drawing, the detail of the compound multilayered circuit board of this invention is carried out.

[0028] Drawing 1 is the appearance perspective view of the compound multilayer-interconnection substrate of this invention, drawing 2 is some of the structure section Figs., and drawing 3 is a structure section Fig. in the condition of having decomposed the part. This compound multilayer-interconnection substrate 10 consists of the ceramic circuit board 1 of two-layer structure, and a glass epoxy group plate 2 of 1 layer structure. The ceramic circuit board 1 consists of ceramic layers 1a and 1b, and between the layer, the internal circuit pattern 11 is arranged and it is. moreover -- the thickness direction of each ceramic layers 1a and 1b -- a beer hall -- the conductor 12 is formed. Moreover, covering formation of the surface circuit pattern 13 is carried out at the one side principal plane (front face) of the ceramic circuit board 1. On the circuit pattern 13 of this front face, each electronic-parts component 3, such as a stacked type

ceramic condenser, a chip resistor which used the ceramic substrate as the base, and a transistor, is connected through solder 31 etc. Furthermore, covering formation of the electrode pad 14 for connection for connecting with the glass epoxy circuit board 2 arranged at a lower part side electrically is carried out at the another side principal plane (rear face: plane of composition joined to the glass epoxy circuit board 2) of the ceramic circuit board 1.

[0029] Moreover, the glass epoxy circuit board 2 consists of one-layer glass epoxy layers, and the circuit pattern 21 is formed in the one side principal plane (plane of composition joined to the ceramic circuit board 1) of the glass epoxy circuit board 2. As for this circuit pattern 21, that part is used as an electrode pad 22 for connection. As compared with the plane dimension of the above-mentioned ceramic circuit board 1, the direction of X and the direction of Y are short a little, and the plane dimension of this glass epoxy circuit board 2 serves as a somewhat small configuration. Consequently, the margin field Z is formed in the periphery of the another side principal plane of the ceramic circuit board 1.

[0030] moreover, the crevice of the shape of a hemicycle through which it pierces in the thickness direction of a substrate forms in the end face of the glass epoxy circuit board 2 -- having -- and the interior -- a conductor -- two or more through holes where the film was put -- the conductor 23 is formed. this through hole -- a conductor 23 is used as an external terminal electrode connected with the mounting substrate 40 of the exterior shown in drawing 4 .

[0031] This external terminal electrode 23 is connected to the circuit pattern 21 of the glass epoxy group plate 2 formed in the principal plane on the other hand.

[0032] In addition, this glass epoxy group plate 2 may be used as a laminated circuit board which consists of two or more glass epoxy layers. In this case, between layers, the circuit pattern which constitutes a predetermined network, and the circuit pattern by which a predetermined function is generated can be arranged, and it can also connect with the external terminal electrode 23 electrically with the circuit pattern between this layer further. moreover, the through hole which pierces through the thickness direction of each insulating

layer -- a conductor may be formed. the beer hall which pierces through each insulating layers 1a-1c in the ceramic circuit board 1 here -- a conductor -- the inside of a through tube -- a conductor -- the conductor which pierces through the thickness direction of a substrate in the glass epoxy circuit board 2 although a member is got blocked and formed -- the wall of a through tube -- a conductor -- the through hole which put the film -- it is formed with a conductor.

[0033] Moreover, the ceramic circuit board 1 and the glass epoxy circuit board 2 The electrode pad 14 for connection formed in the another side principal plane of the ceramic circuit board 1 and the electrode pad 22 for connection of the glass epoxy circuit board 2 formed in the principal plane on the other hand are made to contact. For example, both the circuit boards 1 and 2 are joined through the insulating binders 4 of the glass epoxy circuit board 2, such as an epoxy resin which, on the other hand, avoided the electrode pad 22 for connection of a principal plane, and was applied, for example, does not carry out inorganic substance filler content.

[0034] Moreover, the compound multilayer-interconnection substrate 10 which the wrap shielding case 5 is arranged and shows each electronic-parts component 3 and a circuit pattern 13 by this to drawing 1 is constituted by the front face of the ceramic circuit board 1.

[0035] In addition, a shielding case 5 is fixed while connecting with the circuit pattern 13 of the ground potential formed in the front face of the ceramic circuit board 1 through solder etc.

[0036] This compound multilayer-interconnection substrate 10 is the following, and is made and formed.

[0037] First, the ceramic circuit board 1 forms the large-sized ceramic circuit board which can be extracted.

[0038] the large-sized ceramic green sheet used as large-sized ceramic green sheet and ceramic layer 1b from which this is set for example, to ceramic layer 1a -- preparing -- each circuit board field of each green sheet -- a beer hall -- the through tube used as a conductor 12 is formed. next, the conductor which

supplies the through tube of each circuit board field of a green sheet by printing of a conductive paste, and serves as each circuit patterns 11 and 12 on the front face -- the film is formed by printing of a conductive paste. Next, the laminating of each green sheet is carried out, large-sized a non-calcinated substrate is formed, and a division slot is formed according to the field of each ceramic circuit board 1. then, the conductor of for example, the large-sized the non-calcinated circuit board which serves as the electrode pad 14 for connection in an another side principal plane -- the film is formed by printing of a conductive paste. And the large-sized ceramic circuit board which can extract two or more ceramic circuit boards 1 is completed by carrying out baking processing. Moreover, the glass epoxy group plate 2 is formed at another process. In the large-sized glass epoxy plate with which copper foil was stretched, according to a predetermined network, etching processing is carried out according to a circuit pattern 21 and the electrode pad 22 for connection, and excessive copper foil removes. moreover -- moreover -- the boundary part used as each glass epoxy circuit board 2 -- the hemicycle-like crevice of the side face of the glass epoxy circuit board 2, and a conductor -- copper foil is beforehand formed in a circular through tube and its inside, and nickel plating and gold plate are performed if needed so that the external terminal electrode 23 which consists of film may be formed. Then, cutting processing is carried out for every field of each glass epoxy circuit board 2.

[0039] Here, since the electrode pad 14 for connection of the another side principal plane of the large-sized ceramic circuit board used as the ceramic circuit board 1 forms after laminating sticking by pressure of a green sheet, about 5-10 micrometers of the thickness are from the front face of a substrate.

[0040] And while making the electrode pad 22 for connection of the glass epoxy circuit board 2 formed in the principal plane on the other hand contact the electrode pad 14 for connection of each circuit board field of the another side principal plane of the large-sized ceramic circuit board and obtaining electric connection between both the circuit boards 1 and 2, between both the circuits 1

and 2, insulating binders, such as epoxy system resin which does not contain inorganic substance fillers, such as glass, are made to intervene, and are heated in the state of pressurization.

[0041] Thereby, while hypoviscosity-izing the circuit board 1 and the binder which intervened among two and attaining connection between the electrode pads 14 and 22 for both connection, abbreviation complete adhesion excluding the contact part of the electrode pads 14 and 22 for connection in both the circuit boards 1 and 2 is attained. Thus, a ceramic substrate and a glass epoxy group plate can be joined with glue with the heat resistant resin which has insulation.

[0042] That is, the cut glass epoxy circuit board 2 will be stuck on each circuit board field of the another side principal plane of the large-sized ceramic circuit board, respectively.

[0043] next, each circuit board field of the ceramic circuit board 1 -- on the other hand -- a principal plane -- the various electronic-parts components 3 -- mounting -- reflow solder -- the price -- it solders by the approach. Moreover, trimming is performed if needed for property adjustment of the circuit pattern 13 which performs functional actuation, or adjustment processing of various good transformation component items etc. is performed. Furthermore, a shielding case 5 covers and fixes each electronic-parts component 3 and a circuit pattern 13 at method ** of **.

[0044] Then, each ceramic circuit board 1 is met in the large-sized ceramic circuit board in a division slot, and division processing is performed.

[0045] Thereby, the compound multilayer-interconnection substrate 10 with which the glass epoxy circuit board 2 was stuck on the another side principal plane of each ceramic circuit board 1 can be obtained.

[0046] In this way, the obtained compound multilayer-interconnection substrate 10 is joined by solder to the predetermined wiring pad 41 formed in the mounting substrate 40 with solder 42, as shown in drawing 4. It arranges so that the solder cream might print in the suitable part of the circuit pattern 41 of the mounting substrate 40, next the external electrode 23 of a compound multilayer-

interconnection substrate might specifically print clean solder upwards and it may be located. Then, it is mounted by carrying other electronic parts on the mounting substrate 40, and passing through the process of reflow soldering.

[0047] With above-mentioned structure, by this invention, the circuit board by the side of the upper part in which the electronic-parts component 3 is carried consists of the ceramic circuit boards 1, and the circuit board by the side of the lower part which connects with this ceramic circuit board 1 electrically consists of the glass epoxy circuit boards 2. And it is joined to an external circuit with the external terminal electrode 23 formed in the end face of this glass epoxy circuit board 2.

[0048] For this reason, it mounts on the glass epoxy group plate by which various is carried out as a mounting substrate 40, and the junction by which a crack or exfoliation did not occur and were stabilized into the external terminal electrode 23 which originates in external terminal electrode 23 part also under severe temperature conditions at the difference of a coefficient of thermal expansion, or its soldered joint part 41 can be maintained.

[0049] Moreover, since the electronic-parts component 3 is carried in the ceramic circuit board 1, it can maintain the junction which is the connection of the electronic-parts component 3 and by which a crack or exfoliation did not occur and were stabilized in a part for solder 31 joint also on severe temperature conditions.

[0050] Moreover, since electric connection of both the circuit boards 1 and 2 is contact connection between the electrode pad 14 for connection formed in the another side principal plane of the ceramic circuit board 1, and the electrode pad 22 for connection of the glass epoxy circuit board 2 formed in the principal plane on the other hand, it can maintain the stable electrical installation also under the conditions of a severe temperature change.

[0051] Moreover, junction of both the circuit boards 1 and 2 uses the insulating binder 4 made to be placed between the parts (wide range area between substrates) except the electrode pads 14 and 22 for connection. Thereby, by

pasting up between both the substrates 1 and 2 completely [abbreviation], even if it receives a severe thermal shock, the whole surface can be made to be able to distribute the stress, and the dependability of mechanical junction can be raised.

[0052] Moreover, the dimension of the ceramic circuit board 1 is large the 1 surroundings as compared with the dimension of the glass epoxy circuit board 2. That is, when the insulating binder 4 is made to be placed between the another side principal planes of each circuit board field and the glass epoxy group plate 2 is stuck using the large-sized ceramic substrate from which two or more circuit board fields can extract the ceramic circuit board 1 by the production process (heating sticking by pressure), the excessive insulating binder 4 can make it overflow into the margin field Z of the periphery of the another side principal plane of the ceramic circuit board 1.

[0053] By this, connection between the electrode pad 14 for connection of both the circuit boards 1 and 2 and 22 can be ensured. Since division or the cutting plane line of a large-sized ceramic substrate is located in this margin part, even if it sticks the glass epoxy group plate 2 on the another side principal plane of each circuit element field of the large-sized ceramic circuit board, respectively, since division or cutting down stream processing of a large-sized ceramic substrate can deal with it as one large-sized substrate, that productive efficiency will be moreover, good.

[0054] Moreover, the ceramic circuit board 1 in which the electronic-parts component 3 is carried, and since it is a little large, an element-placement field is fully securable. Since the glass epoxy circuit board 2 is a little small, mounting occupancy area of the mounting substrate 40 can be made small at coincidence.

[0055] moreover, the conductor of the electrode pad for connection contacted mutually which only 5-10 micrometers of electrode pads 14 for connection by the side of the ceramic circuit board 1 projected from the another side principal plane of the circuit board 1 on the other hand -- since it is the film, the two-electrodes pads 14 and 22 can be contacted stably.

[0056] And as a result of contacting the two-electrodes pads 14 and 22, corresponding to the projected thickness, a gap occurs between both the circuit boards 1 and 2. And it is placed between these gaps by the insulating binder 4. That is, it becomes the glue line of sufficient thickness and the stress by the difference of a coefficient of thermal expansion becomes is easy to be absorbed.
[0057] And when it joins by solder to the mounting substrate 40, since the solder fillet formed in external terminal electrode 23 part is superficially concealed in the margin part of the ceramic circuit board 1, mounting of it with it is attained on the mounting substrate 40, and since an impact is hard to be impressed from the exterior to this soldered joint part, moreover, it does not have that degradation, either. [a small and mounting occupancy area and] [firm]
[0058] Next, the gestalt of the operation of the compound multilayer-interconnection substrate of this invention of an antenna change module as another example of a way high frequency module is explained. The circuitry consists of a switch and a filter greatly by the switch module for an antenna module to change and use an antenna by the transmitting module and the receiving module.
[0059] In the case of an antenna module, the electronic-parts components 3 including a PIN diode are carried in the upside ceramic circuit board 1, and a switching circuit is formed. The pattern of the filter by the stripline is formed in the glass epoxy circuit board 2 by the side of the lower part. At this time, the frequency regulation of a filter can be finished in the phase of the glass epoxy circuit board 2 by the side of the lower part. If it does in this way, required processing of trimming processing etc. can be performed at the time of formation of the glass epoxy circuit board 2 by the side of the lower part, and, moreover, processing processing can be carried out independently of formation of the ceramic circuit board 1 by the side of the upper part.
[0060] Thereby, adjustment and trimming of a property can manage an abbreviation thru/or very slight trimming after the lamination of the ceramic circuit board 1 and the glass epoxy circuit board 2.

[0061] Moreover, when the configuration of forming the pattern of the filter by the stripline in the glass epoxy circuit board 2 by the side of the lower part, carrying the electronic-parts components 3 including a PIN diode in the ceramic circuit board 1 by the side of the upper part, and forming a switching circuit is taken, the filter by the stripline serves as appearance shielded by the circuit of a ceramic substrate from the outside, and becomes unnecessary [a shielding case 5] depending on a module. Substrate area can be further miniaturized by this.
[0062] Furthermore, since the ceramic circuit board 1 by the side of the upper part is common and can be used, by choosing and combining the glass epoxy circuit board 2 (that from which a filter pattern is changed and a property and a frequency differ) stuck to a large-sized ceramic substrate, it can attain communalization of a member and can heighten volume efficiency.
[0063] In addition, although thickness is given substantially, you may make it the electrode pad 22 for connection of the one side principal plane by the side of the glass epoxy circuit board 2 also make the electrode pad 14 for connection by the side of the ceramic circuit board 1 project from a substrate principal plane in the above-mentioned example.
[0064]
[Effect of the Invention] As mentioned above, according to the compound multilayer-interconnection substrate of this invention, the ceramic circuit board and the glass epoxy circuit board are stuck, and it is a configuration. And it constitutes from the ceramic circuit board of the side in which an electronic-parts component is carried, and the glass epoxy circuit board of the side mounted in a mounting substrate. By this, degradation of the joint by the difference of a coefficient of thermal expansion, i.e., the soldering section, can be effectively suppressed between the glass epoxy circuit board and a mounting substrate between the ceramic circuit board and an electronic-parts component.
[0065] Moreover, the ceramic circuit board is a large-sized substrate as compared with the glass epoxy circuit board. And the external terminal electrode etc. is not provided. For this reason, the element-placement side of an electronic-

parts component can be used widely, and it is small and element-placement mark can be made [many], and mounting occupancy area is small and serves as a compound multilayer-interconnection substrate in which high density assembly is possible.

[0066] Moreover, since at least one side of the electrode pad for connection each other connected has projected by predetermined thickness from the substrate, both electric connection becomes certain, the stable electric connection is maintainable, and since an insulating binder can be made to be placed between the gaps formed physically, the mechanical junction stabilized by this is attained.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the perspective view showing the compound multilayer-interconnection substrate of this invention.

[Drawing 2] It is the fragmentary sectional view of the compound multilayer-interconnection substrate of this invention.

[Drawing 3] It is the decomposition sectional view of the part corresponding to drawing 2 .

[Drawing 4] It is a partial side elevation when mounting in the mounting substrate of this invention.

[Drawing 5] It is the perspective view of the conventional multilayer-interconnection substrate.

[Description of Notations]

1 Ceramic Circuit Board

2 Glass Epoxy Circuit Board

3 Electronic Parts

4 Insulating Binder

5 Shielding Case

11 Internal Circuit Pattern

12 Beer Hall -- Conductor

13 Surface Circuit Pattern

14 Electrode Pad for Connection by the side of Ceramic Circuit Board

21 Circuit Pattern by the side of Glass Epoxy Circuit Board

22 Electrode Pad for Connection by the side of Glass Epoxy Circuit Board

40 Mounting Substrate

[Translation done.]

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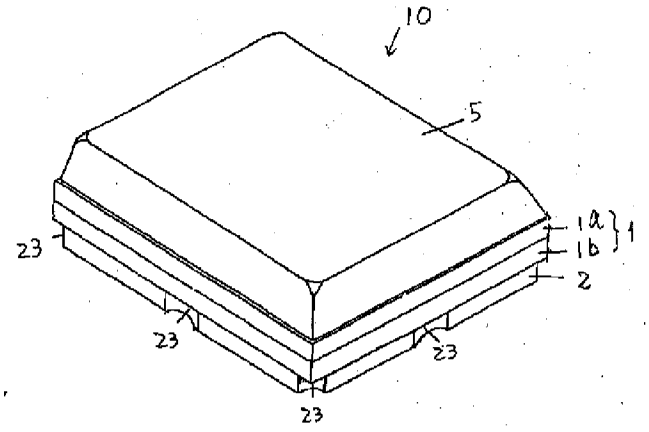
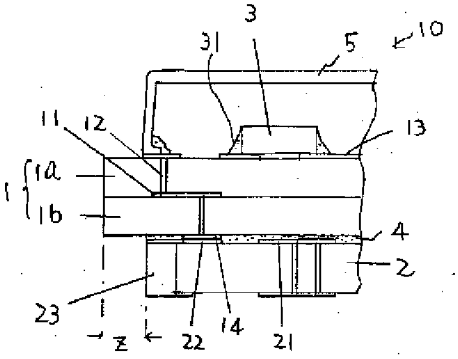
DRAWINGS

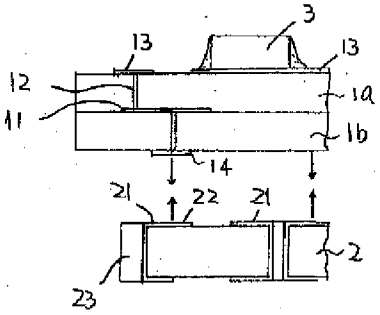
[Drawing 1]



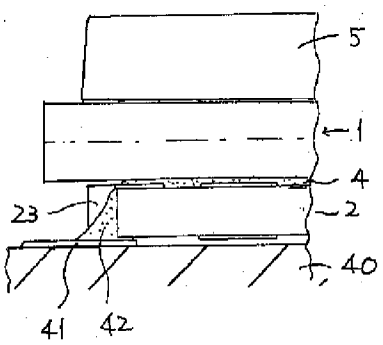
[Drawing 2]



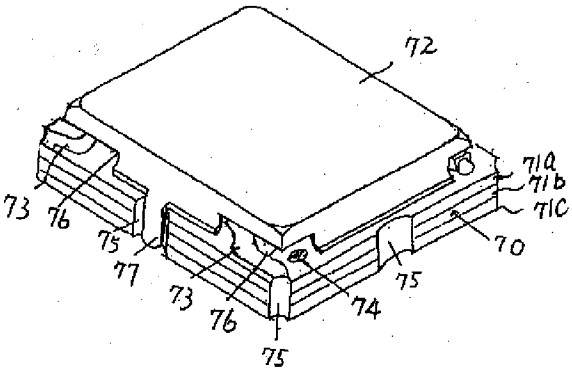
[Drawing 3]



[Drawing 4]



[Drawing 5]



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